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a liquid crystal layer sandwiched between said first substrate and said second substrate, wherein said pixel electrode has two recesses formed therein, a first recess in groove shape such that said first recess fixes a boundary between two said pixels when a voltage is applied between said pixel electrode and said opposite electrode, and a second recess for connecting said pixel electrode to a source electrode of an associated TFT.

REMARKS

Claim 1 has been amended to clarify the invention, and to better define the invention over the prior art. Claims 11 and 12 have been cancelled. No new matter has been entered. Pursuant to 37 CFR § 1.121, a marked copy of amended claim 1 showing the changes made therein accompanies this Amendment.

Now turning to the art rejections, the rejection of claims 1 and 5 under 35 USC § 102(e) as being anticipated by Rho et al. (US Patent 6,057,896) is improper. Claim 1, as amended, requires a pixel electrode containing two recesses with one recess functioning as a contact hole and the other recess fixing a boundary between two pixels when a voltage is applied to the electrodes. Rho et al. does not teach a recess in the pixel electrode acting as a boundary. Rho et al. contains two recesses 120, 130, but neither is used to divide the pixels. Both recesses act as contact holes (col. 5, line 7 and col. 6 line 8). Rho et al. teaches that the gate line 21 and the data line 81 define the pixel region (col. 5, lines 11-12). The pixel electrode 140 extends through both grooves 120, 130, but not the gate line 21 or the data line 81. See FIGS. 2, 3. Thus, Rho et al. does not anticipate Applicants' invention because it does not teach a recess in the pixel electrode dividing two pixels. Claim 5 is allowable because it depends directly on claim 1.

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The Examiner also rejected the several claims as obvious from various art combinations, including: (1) Tokuo in view of Rho et al. (claims 1,2,7-9, 18 and 19); (2) Tokuo in view of Rho et al. as applied to claims 1 and 2 (claims 3 and 4); (3) Tokuo in view of Rho et al. as applied to claims 1 and 2, and further in view of Lyu et al. (claims 16 and 17); (4) Tokuo in view of Rho et al. as applied to claims 18 and 19, and in further view of Shimizu et al. (US Patent 6,431,002) (claims 20 and 21); (5) Tokuo in view of Rho as applied to claim 2, and further in view of Yoshida et al. (US Patent 6,222,599) (claim 10); (6) Rho et al. as applied to claim 1, and further in view of Tokuo (claims 2, 6, 9 and 14); (7) Rho et al. as applied to claim 1 (claim 3); and (8) Tokuo as applied to claims 1 and 2 in view of the Admitted Prior Art (APA) (claim 13). These rejections are also improper. All of the rejections are based on Rho et al. or Tokuo or combinations of them with secondary art. The deficiencies of Rho et al. vis-à-vis Applicants' claimed invention are discussed above. The Examiner admits "Tokuo does not explicitly disclose a second recess in groove shape" used to divide the pixels. Detailed Action, page 5, lines 8-9. As previously discussed, Rho et al. also does not teach a recess dividing the pixels. Therefore, no combination of Tokuo and Rho et al. can render obvious Applicants' independent claim 1 or any of its dependent claims.

None of the secondary references provides the missing teachings to Rho et al. and/or Tokuo: Lyu et al. deals with optical properties of liquid crystals; Shimizu et al. teaches the proper twist angles for the liquid crystals; Yoshida et al. staggers the positions of the electrodes on the second substrate. None of these references or the APA teaches having two recesses in the pixel electrode and using one to divide the pixel regions.

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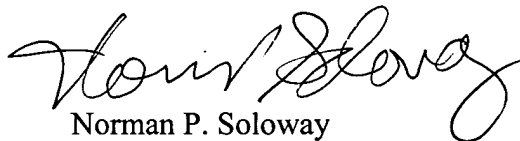
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Finally, turning to the rejection of claims 1 and 5 under 35 USC 103(a) as being unpatentable over the APA in view of Hirata et al. (US Patent 6,141,077), the Examiner admits that APA does not teach a pixel electrode with recesses in a groove shape. Detailed Action, page 16, lines 4-5. Hirata et al. teaches using bumps of different height to improve viewing angle characteristics. While the bump patterns can stretch across more than one pixel in Hirata et al., the recesses do not act as a boundary line. See Example 2 in column 10-11. The purpose of the bumps and recesses is to improve the view angle, not to divide two pixels. Thus, the combination of APA and Hirata et al. does not render obvious Applicants' invention.

It is believed therefore, the Application now is in order for allowance. Early and favorable action are respectfully requested.

In the event there are any fee deficiencies or additional fees are payable, please charge them (or credit any overpayment) to our Deposit Account No. 08-1391.

Respectfully submitted,



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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Assistant Commissioner of Patents, Washington, D.C. 20231 on January 17, 2003, at Tucson, Arizona.

By Najat Mshalemi

MARKED COPY OF AMENDED CLAIM 1

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MARKED CLAIM 1 SHOWING CHANGES MADE

1. (Twice Amended) An active-matrix liquid crystal display comprising:

a first substrate including a pixel electrode provided for each pixel, and a driving element provided for each of said pixel electrodes;

a second substrate disposed opposite to said first substrate and including an opposite electrode; and

a liquid crystal layer sandwiched between said first substrate and said second substrate,

wherein said pixel electrode has two recesses formed therein, a first recess in groove shape [for dividing said pixel electrode into two parts] such that said first recess fixes a boundary between two said pixels when a voltage is applied between said pixel electrode and said opposite electrode, and a second recess for connecting said pixel electrode to a source electrode of an associated TFT.